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FINNISH PRIMARY TEACHERS' INTERACTION WITH CURRICULUM MATERIALS – DIGITALISATION AS AN AUGMENTING ELEMENT

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This paper investigates how Finnish primary teachers talk about their interaction with curriculum materials, especially the additional facilities that digitalisation and technology provide to mathematics education. Digital curriculum materials are seen as part of available resources for teaching and learning mathematics. The data of this qualitative study consists of semi-structured interviews with seven primary teachers. Six thematic categories emerge in the data illustrating the elements that teachers consider crucial in evaluating and using the curriculum resources. The Finnish teachers prove to be critical and strategic consumers who understand the potential of the digital curriculum materials but make decisions about the use primarily in terms of enhancing student learning.

INTRODUCTION

Digital resources, theorizing the character of them and research on how they transform educational processes and practices have been recently under elaboration (Pepin, Choppin, Ruthven & Sinclair, 2017). While we know relatively much about teachers' interaction with printed curriculum resources (e.g. Brown, 2009; Remillard, 2005), research on the interaction with digital resources has yet to be fully explored. There has been a concern about how teachers manage to choose among the rapidly changing and easily available digital tools for mathematics learning (Hollebrands, 2017), and if they tend to seek for new resources in the first place (Tanhua-Piironen, Viteli, Syvänen, Vuorio, Hintikka & Sairanen, 2016). This paper reports an exploratory study that sets a ground for a larger scale cross-cultural research aiming to increase our understanding of the capacity required for teachers to use these resources well and the factors that influence it. We need to fill the gap in our knowledge about, on the one hand, how the growing supply of digital curriculum resources impact teachers' classroom practices and, on the other hand, how teachers perceive the ongoing change and expectations to be met.

Finnish teachers have great autonomy in making decisions about the supply of curriculum resources and the way they wish to utilise such materials in their mathematics classes. Still, the development of mathematics curriculum materials and teacher guides in particular have had an important role in enhancing new ways of teaching mathematics in Finland (Pehkonen, 2004). Finnish curriculum materials are commercially produced with no national inspection of them. Information of upcoming curriculum reforms is available in public that enables publishers to produce materials

that are in line with the current national core curriculum setting the outline for school education.

This paper focuses on teachers' stance towards digital curriculum materials as part of various resources available for teaching and learning mathematics. Earlier research has often focused on the use of either traditional or digital curriculum materials but instead, our approach is to consider the curriculum resources to comprise a whole package despite the source or the form of the material (Ruthven, 2014; cf. Pepin et al., 2017). Especially, the aspects characterising teachers' perception of the curriculum materials and thus serving the basis for choosing and using particular resources are at the core of the study. The research question is how the Finnish teachers perceive digital curriculum material in their mathematics teaching.

THEORETICAL FRAMEWORK

There is a need for understanding the foundations for change and potential when applying digital curriculum resources in mathematics classroom (e.g. Pepin et al., 2017). The globalization of the curriculum publishing industry and the fact that digital resources are available to teachers throughout much of the world generate a new setting for studies on curriculum use. Recently, it has been argued that the research field should focus on digitalization from a teacher's perspective, building on the knowledge of teachers' use of print resources, and taking into account features that are unique to digital resources. The demands placed on teachers and potential to support them should be considered in such research (e.g., Hoyles & Lagrange, 2010), particularly since there is evidence to suggest that particular characteristics of digital resources put different demands on the teacher (Remillard, 2016).

One theoretical perspective proposed by Remillard (2005) conceptualizes teachers' curriculum use as a dynamic interplay between the teacher and the curriculum resource, and thus, it views the curriculum use as a participatory process rather than a passive process of implementation. Along this line, a construct frequently referred to is Pedagogical Design Capacity (PDC) (Brown, 2009). PDC refers to "an individual teachers' capacity to perceive and mobilize existing resources in order to craft instructional episodes" (p. 29). This capacity includes the skill required to perceive and interpret the affordances of curricular resources and make decisions about how to deploy them to planning for instruction. Still needed is research on teachers' PDC in relation to digital resources.

Teachers seem to face a challenge when applying new digital resources in the classroom. Ruthven (2014) discusses the role of teaching expertise underpinning the successful use of digital technology in the mathematics classroom. In his framework, the tension arises from trying to apply new digital resources in line with existing elements, such as textbooks and traditional facilities. Hollebrands (2017) brings about the challenge of educating future teachers to be competent and willing to choose critically from the available curriculum resources in order to enhance student learning. For example, prospective teachers' stance towards digital curriculum resources are

found to be characterised by the aspects related to surface features of the software and providing a motivational tool, for example, fun in mathematics classroom rather than deeper engagement with enhancing mathematical understanding (Johnson and Suh, 2009; Smith, Shin & Kim, 2017). Contrary to these findings, Pepin et al (2017) highlight three features that make the use of digital curriculum resources beneficial for teachers: 1) flexibility in terms of adaptation and redesign when applying the resource and potentially work in social and professional environment; 2) potential for differentiation and personalisation when addressing the needs of individual students; and 3) tools for assessment, namely access to pupil learning and potential for monitoring the progress.

METHOD

This qualitative case study (Bryman, 2012) is based on insights emerging in the interviews with seven Finnish primary teachers in autumn 2017. Since the aim was to understand various approaches into the use of curriculum resources and the way teachers evaluate mathematics curriculum materials as part of their work, we invited primary teachers representing different grade levels (1-6) and teaching experience, different schools, school regions and school size to participate in the study. The data consists of one-hour semi-structured interviews based on the themes related to 1) teacher background and school environment, 2) the curriculum resources in use, 3) views on curriculum material usage, and 4) views of teaching and learning mathematics. The interview took place in the classroom of each teacher that allowed the researcher to see the environment and look at the curriculum materials during the interview if needed.

The analysis started with transcribing the recorded data and identifying the three aspects that Pepin et al. (2017) associate with the beneficial use of digital curriculum resources. Three additional themes, i.e. supplementary facilities of realization, contribution to teaching and learning mathematics, and practical aspects, emerged from the data along the analysis. The trustworthiness of the study is strengthened by a pilot study for testing the original interview protocol in spring 2017. Furthermore, the analysis was carried out in several cycles parallel by two first authors that helped to ensure a consistent and trustworthy manner of the analysis. (cf. Bryman, 2012)

RESULTS

Teachers consider six emerging features when reflecting on their relation with digital resources as part of the available mathematics curriculum material and the use of them in teaching mathematics.

Flexibility in terms of adaption

The most usual way to utilize the flexibility of the digital materials is to modify the available tests that are included in teachers' curriculum material. The teachers stated that they select the test items in accordance with what they have taught and what students could possibly manage.

...I actually try to select such tasks that I assume my students to understand. Not necessarily that easy but similar to assignments that we've done in the class (Teacher 3)

Teachers found that the flexibility of available digital materials varies. On the one hand, the conveyance tools of the curriculum resource (Dick & Hollebrands, 2011) are seen stiff, not flexible. If the content and the logic of animations are not in line with teachers own thinking, it is found as a hindrance for fully adapting the material into teaching.

If you don't go through them [animations] well beforehand it's likely to be surprised what happens when you click the arrow forward [for the next step]] ...then the timing of instructional speech is sometimes wrong. It's inconvenient. And sometimes it takes several rounds to understand the logic behind. (Teacher 4)

On the other hand, some teachers prefer the same resources particularly as it is time-consuming to develop flexible digital materials to suit one's own ideas. Teachers rely on traditional working methods and, for example, the use of concrete materials because they know well how to adapt such implementation smoothly in their teaching.

the digital material of the textbook series is something like you still need to add a lot of elements yourself... if I need to invent something by myself I prefer to draw or use macarons or do arts and crafts... (Teacher 7)

Surprisingly, no teacher brought about the flexibility of the digital resources in terms of designing lessons collectively, creating professional development sessions or working distance (cf. Pepin et al., 2017).

Personalization and differentiation

All Finnish teachers in our study seem to seek for such tools that allow them to take account of different learners, for example, high-achievers, students with learning disabilities or the ones speaking Finnish as a second language. This overlaps with the previous category when designing tests suitable for different learners. Teachers appreciate the possibilities of personalization and differentiation in general when using the curriculum materials. The personalization can be obtained by a variety of digital tasks that the teacher can choose from or by an application that vary the difficulty of tasks according to prior performance.

You don't need to indicate the same [tasks] for everyone as there're plenty of them, as many as you feel up to do... low-performing students had some tasks that repeated really the basics instead of doing average level tasks... (Teacher 1)

Teachers provide their students possibilities to choose from various additional activities after completing the basic level tasks of the textbook. Teachers appreciate also that the digital materials allow students to work at home online.

Logging in with personal identification made it easy to continue working at home and it [assignment] was completed on the Internet (Teacher 1)

Yet, teachers reflected on the meaning of knowing the available material thoroughly in order to utilize it efficiently. Teachers highlighted the meaning of special introduction

training when starting to use a new resource in order to understand the underlying idea and to picture up the supply of tasks to be used with students.

I'd like to participate also myself if the training was available. The problem is to find time for becoming familiar with such a broad supply... that you'd know who benefits from which tasks (Teacher 5)

Assessment and monitoring student learning

Teachers hardly reflected on the possibility to develop assessment procedures and tools for summative or formative assessment in order to monitor student learning. Only one teacher mentioned the benefits provided by digital materials that allow easy access to witness student progress and direct the pathway that an individual student takes.

It's easy for a teacher to monitor and download new assignments weekly and then check who had completed them all (Teacher 1)

Supplementary facilities of realization

Teachers paid attention to supplementary facilities that digital resources potentially provide if compared to printed ones, namely, ready-made exact drawings and illustration presented with animated digital manipulatives.

The biggest change when digital materials appeared in the market... it was a huge thing to replace multi-links and manipulatives and such material... because it's really clear in my opinion that you can show them on the board and pause and go back and forth (Teacher 1)

One teacher highlighted the importance of making mathematical process visible. He found it easier to accomplish such demand with the traditional blackboard instead of digital presentations. The meaning of using concrete materials, for example, ten base manipulatives divided the teachers. On the one hand, possibility to work with concrete materials and laboratory work comprise the ground for learning mathematics, i.e. embodied activities and tactile experience serve the basis for the learning process of the students.

I use a lot of laboratory work and I have certain materials available. At the moment, ten base manipulatives have served the ground for expanding the number area... it's the corner stone of the autumn term. (Teacher 6)

On the other hand, teachers discussed the expectation from digital curriculum material to provide additional facilities, namely something new.

It seems that digital extra material is just like doing tasks similar to the ones our textbook includes but doing them without a pen... it'd be better to have different than the textbook tasks by nature (Teacher 5)

However, digital curriculum materials seem to provide poorly an overall package for mathematics classes, and thus, textbooks still play a central role in schoolwork. The printed material was found sometimes more convenient to access, for example, when flipping through the provided curriculum elements and picturing up the overall idea of a particular lesson. Still, teachers found single activities such as games and interactive tasks an important additional affordance in learning mathematics.

View of teaching and learning mathematics

Teachers appear to be critical consumers of all kind of curriculum material but especially of digital materials that are to open up new sceneries in mathematics classrooms. They evaluate the curriculum material in terms of whether they support student learning and achieving learning objectives. Hence, these teachers appreciate materials that include various kinds of tasks, not only training calculation skills. Mathematical thinking emerged as a core theme.

It's about encouraging students to think, communicate and apply mathematics. The idea isn't to learn through repeating things but instead using own head (Teacher 7)

Curriculum material should be mathematically correct and clear in order to avoid confusing children by an unfamiliar task form or unclear assignment.

The assignment is about which numbers you find between two given numbers [in the number line] but it says nothing about dealing with whole numbers... if you just use it straightforward, well-performing students are lost (Teacher 4)

Although the teachers strive to make mathematics meaningful for students, they stressed that the aim of using digital material is not just to entertain students or making mathematics fun. They understand their role to be responsible for choosing such curriculum resources that push towards reaching good learning outcomes. Teachers seem to work with curriculum materials in a way that it suits their views of teaching and learning mathematics and personal readiness for utilizing various resources.

Practical aspects

Various practical issues emerge especially when utilising digital materials. Technical problems make teachers frustrated when applying digital resources and technology.

It's extremely frustrating to see that digital materials have worked poorly during the recent years, it's my opinion. It's the reason why I've kept some old [mathematics] textbooks in my cupboard. It makes it possible to find at least some types of tasks and use them by putting something together myself, even have photocopies (Teacher 4)

Starting to use new digital materials is seen demanding and many times the user interface seems to be unclear or too complicated for both students and a teacher. The prevailing habit to use traditional textbooks in mathematics classes is strong still nowadays. A challenge is to diversify the way mathematics curriculum materials are used.

Some students questioned it also, like why they need to use computers all the time... we've done some other projects with them... I think we do all sort of things with computers and I felt that I don't need to promote digitalisation especially in mathematics if I don't feel like it (Teacher 6)

One teacher discussed about the challenges caused by students being unfamiliar with the user interface of a particular application. Thus, a great deal of valuable lesson time might be lost for solving practical problems. Moreover, teachers feel that practical arrangements take sometimes too much time and effort if compared to gained benefits.

For example, last time when I'd booked the laptops for my class and I got them, then we couldn't log in. It took almost the whole lesson. I think we did some three assignments before starting the lesson break... and we're supposed to rehearse for the test and the whole session was a disaster (Teacher 3)

A practical hindrance is that it is time-consuming to find high-quality material on the Internet and getting familiar with the supply of digital curriculum material.

DISCUSSION

Our study shows that the Finnish teachers seem to be critical consumers of the digital curriculum materials. They choose carefully the resources and especially in which ways to utilize them in mathematics teaching. However, teachers seem to expect that the curriculum material provides augmenting facilities and the use of the material is worth the effort; for example, that the digital material enables them to work more efficiently than before or provides new approaches to mathematics teaching. Digital curriculum materials serve to be a purposeful resource only if the teachers recognize a clear contribution to student progress and a help in schoolwork (cf. Pepin et al, 2017). Teachers see the curriculum resources as an overall package and they utilize the resources in their classrooms firstly for enhancing student learning and improving the quality of their own work.

We found hardly evidence about teachers to prioritise either making mathematics fun or other issues related 'edutainment' when evaluating the potential curriculum material. The surface level features of the curriculum material hardly guide the decision-making and the use of the digital curriculum material (cf. Johnson and Suh, 2009; Smith, Shin & Kim, 2017). The novelty of digital curriculum materials and technology serve no additional value without a clear contribution to the quality of teaching and learning mathematics. Teachers have high expectations.

The Finnish teachers are principally willing to apply new resources in their classroom and see the potential of the modern resources. Recent concern has focused on the quantity of using digital and technological resources (e.g. Tanhua-Piironen et al., 2016). Instead of blaming the school system or reluctant teachers, the focus should be on developing such curriculum resources that provide a meaningful addition to existing supply and in which pedagogical aspects would be of a primary concern. The traditional approach to curriculum materials seems to outperform still in the beginning of the 21st century.

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